DOCUMENT RESUME

ED 444 556 IR 020 212

AUTHOR Bowers, Janet; Kenehan, Garrett; Sale, Jeff; Doerr, Helen M.
TITLE Designing Multimedia Case Studies for Preservice Teachers: Pedagogical Questions and Technological Design Solutions.
PUB DATE 2000-00-00
NOTE 6p.; In: Society for Information Technology & Teacher Education International Conference: Proceedings of SITE 2000 (11th, San Diego, California, February 8-12, 2000). Volumes 1-3; see IR 020 112. Figures contain very small and illegible type.
PUB TYPE Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Case Studies; *Courseware; Higher Education; *Instructional Design; Instructional Effectiveness; *Material Development; Multimedia Instruction; *Multimedia Materials; Preservice Teacher Education; Teaching Methods

ABSTRACT

This paper discusses the following pedagogical questions and technological solutions that evolved as three multimedia case studies for preservice teachers were developed: (1) What tools can be garnered to encourage preservice teachers to look beyond superficial aspects of a classroom to observe the complexities of the teaching and learning process? (2) How can preservice teachers be engaged in the process of teacher reflection? (3) How can this case study be made different from a video by exploiting the use of multimedia? (4) How can preservice teachers be engaged in the mathematics of the lesson and encourage them to anticipate possible student strategies? (5) How can instructors be supported who are planning to use the CD-ROM in their classrooms? and (6) What technological boundaries will need to be overcome? The design goal of the project was to create a means for helping preservice teachers observe the complexity of the teaching and learning process through the use of innovative multimedia tools. The research goal was to document how the different versions of the case have been implemented in various teacher preparation courses and then report which features of the case were found to be consistently efficacious in supporting the teacher educators' curricular goals. (MES)

DESIGNING MULTIMEDIA CASE STUDIES FOR PRESERVICE TEACHERS: PEDAGOGICAL QUESTIONS AND TECHNOLOGICAL DESIGN SOLUTIONS

Janet Bowers, Mathematical and Computer Sciences Dept., San Diego State University, USA
(Jbowers@sunstroke.sdsu.edu)

Garrett Kenehan, Mathematical and Computer Sciences Dept., San Diego State University, USA
(Gkenehan@sunstroke.sdsu.edu)

Jeff Sale, College of Sciences, San Diego State University, USA
(JSale@sunstroke.sdsu.edu)

Helen M. Doerr, Dept. of Mathematics, Syracuse University
(hmdoerr@sued.syr.edu)

Abstract: This paper discusses some of the pedagogical questions and technological solutions that evolved as we developed three multimedia case studies for preservice teachers. The design goal of this project was to create a means for helping preservice teachers observe the complexity of the teaching and learning process through the use of innovative multimedia tools. The research goal of the project was to document how the different versions of the case have been implemented in various teacher preparation courses around the nation and then report which features of the case were most found to be consistently efficacious in supporting the teacher educators' curricular goals.

The problem we are addressing

One of the most difficult problems facing teacher educators is that prospective teachers lack the experience base necessary to meaningfully observe the complex and rapid interactions that occur in any classroom. This shortfall may be responsible for prospective teachers' well-known tendency to focus on classroom management issues (such as counting the number of girls the teacher acknowledges) rather than the more content-specific pedagogy that is taking place. Although these management issues are of interest and importance (especially to beginning teachers), they do not tell the whole story. In particular, they do not lend themselves to promoting the development of pedagogical content knowledge (Shulman, 1986), which includes the intricate interplay between elements of epistemology, psychology, mathematics and pedagogy. Due to its complexity, such knowledge cannot be transferred by narrative means. However, we believe that students can become mindful of such knowledge by observing how experienced teachers emphasize specific mathematical solutions or how the teacher and students develop taken-as-shared understandings of various mathematical meanings.

A second implication from this lack of experience in analyzing classrooms is that it prevents preservice teachers from engaging in deeper analyses of the relation between the teacher's actions and the students' understandings that characterize the concerns of reflective practitioners (Schon, 1983). The goal of our project has been to address these problems by designing CD-ROM based case materials that might enable mathematics teacher educators to bring the complexities of a classroom into focus. In other words, our goal has been to promote the development of preservice teachers' pedagogical content knowledge by facilitating access to critical classroom segments that promote discussions of mathematical content and pedagogy.

Design Theory

Our design theory is based on two related areas of research and development. The first area concerns the use of case studies to develop pedagogical content knowledge. According to Shulman (1986), there are several different types of case studies (i.e., prototypes, precedents, and parables) but all share one essential feature: they are not simply random anecdotes. Instead, they are stories that are chosen to illustrate a theory or communicate a moral. Thus, Shulman notes that effective cases should enable viewers to contrast general ideas with concrete, memorable events.

The second area of work that has guided our design efforts is the use of multimedia materials with preservice teacher education. The emphasis of most projects in this field has been to focus on asking 'how can we use multimedia to engage students in the processes of reflective practitioners?' We have drawn on the approach of Mousley & Sullivan (1997) who use pedagogical dilemmas to provoke detailed lesson analyses and to perturb users' assumptions about teaching and learning. The underlying assumption of their work, with which we completely concur, is that unless personal constructs are challenged, teachers are not likely to see any need for change. We have also drawn on the work of Merseth & Lacey (1993) who discuss the possible advantages of using multimedia case studies. These advantages include the potential to present multiple perspectives on given issues and the opportunity to actively engage students in their own explorations of the teaching and learning process. Although our earlier work has included multiple perspectives from various educators and mathematicians looking at the same video segment (cf., Barron, Bowers & McClain, 1996) we have chosen in this project to focus more directly on engaging students in their own explorations via the use of multimedia tools.

Overview of the Cases

Our work to date has involved the creation of three versions of one mathematics case: a one-day case, a four-day case, and a video-only version of the four-day case. Each of the cases involves similar content: a series of lessons involving data analysis activities implemented in middle school classrooms. The reason for creating three design versions was to research any differences in what each model could afford.

Pedagogical questions and technological solutions

1. What tools can we develop to encourage preservice teachers to look beyond superficial aspects of a classroom to observe the complexities of the teaching and learning process?

In an effort to clearly delineate some of the issues we found particularly critical, we developed an interactive issues matrix (cf., Barron, Bowers & McClain, 1996). As shown in Figure 1, clicking on any "X" in the matrix will bring the user to a video segment, teacher reflection, or lesson plan notation that pertains to the indicated issue and day. The intended goal of this matrix is to enable preservice teachers to investigate an issue or theme as it progresses over the span of the lesson sequence.

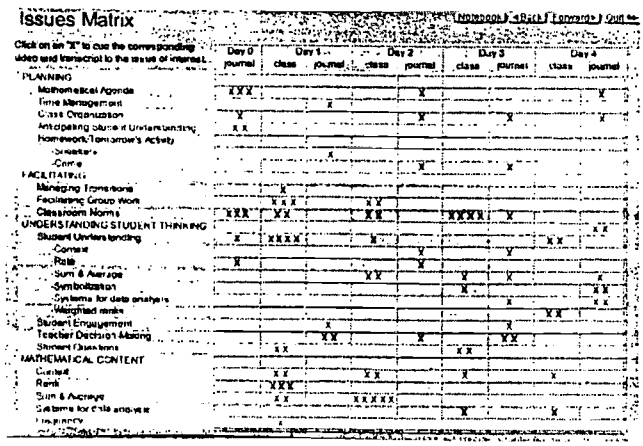

Figure 1. Issues matrix from 4-day case

A second technological tool that was designed to facilitate deeper analyses of the video is the bookmarking feature. This feature allows users to customize their investigations. For example, it can be used by methods instructors to mark a particular segment of video and ask a question in a linked text box. The feature can also

be used by preservice teachers to mark, annotate, save, and later retrieve specific segments for later review (as shown in Figure 2).

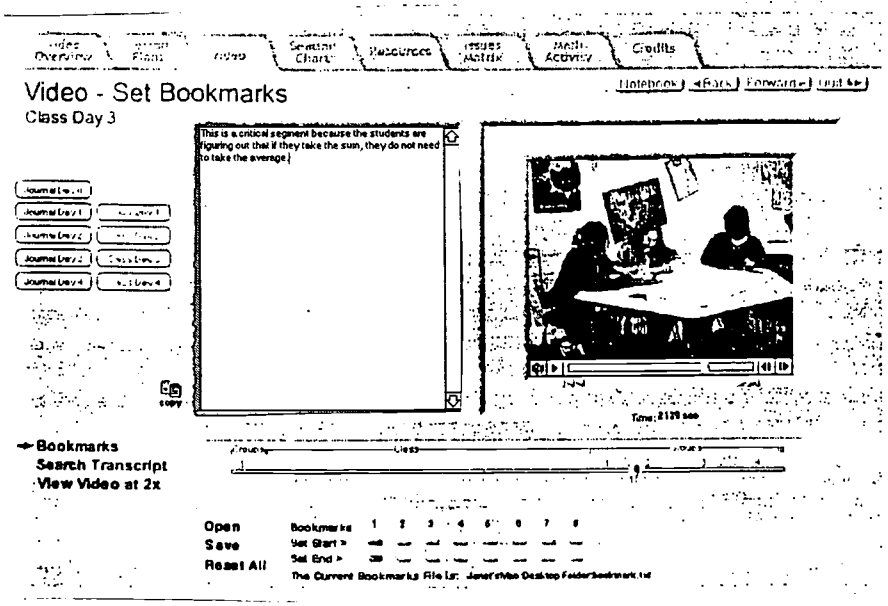

Figure 2. Setting a bookmark.

A third technological solution that we have developed to address the difficulty of conducting large-scale analysis across time is the searchable transcript. This transcript, which is linked to the video, is searchable by keyword or phrase. This enables pre-service teachers to search for particular mathematical topics or follow a specific student (via a name search) across time. For example, a user might want to investigate whether the teacher anticipated students' use of a computing average strategy and then search both the teacher transcript (as shown in Figure 3) as well as the classroom transcript for occurrences of this key word. The search results list can be saved via a text file that contains hypertext links to the keyword in the transcript and video.

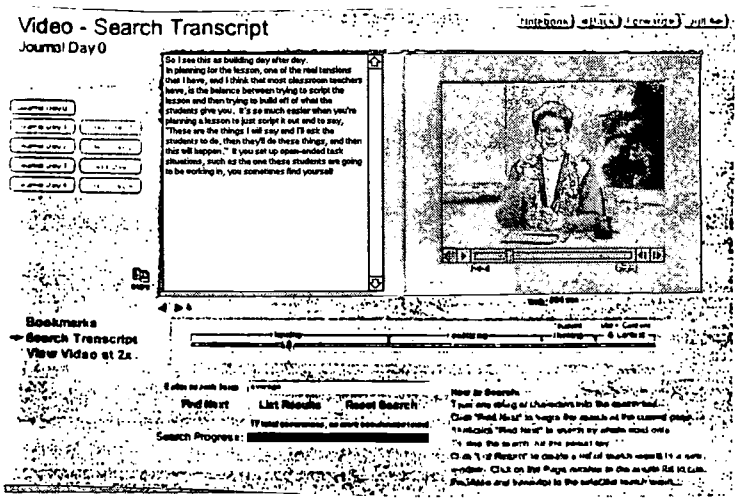

Figure 3. Results of searching linked transcript for word "average."

2. How can we engage preservice teachers in the process of teacher reflection?

One of the issues we wanted to illuminate with the cases was the way in which experienced teachers reflect on their preparation and daily teaching experiences. To this end, we videotaped the teacher's initial reflection on her lesson plan as she prepared for her class each day and then again as she reflected on how each lesson was realized in the classroom and how she would subsequently revise the next day's lesson plan. These sessions were videotaped sequentially to capture the teachers' actual concerns as they occurred in time and therefore show both a) the value of a priori reflection on possible mathematical solutions, and b) the reality of how even a well-planned lesson can still lead to unanticipated student reactions.

3. How can we make this case study different from a video by exploiting the use of multimedia?

One difficulty that often arises in discussions of a shared video is how to identify students by name. When observers are only "introduced" to a student on video once or twice, they naturally have difficulty distinguishing them or recalling names to conduct a keyword search. To facilitate recognition, we have included pictures of each student arranged by group and desk location in the classroom. A second multimedia tool we have made extensive use of is the inclusion of scanned images of student work, copies of all lessons, and other auxiliary materials for the case. We believe that such artifacts distinguish a rich case from a video-based story, and will be researching this hypothesis over the coming year.

4. How can we engage preservice teachers in the mathematics of the lesson and encourage them to anticipate possible student strategies?

Another aspect of this CD that distinguishes it from other pedagogical cases is the mathematical activities section. In this section, we provide users with the actual information and data that the students in the video are using. Our goal in so-doing is to have the observers watch the teacher introduce each activity, and then engage in the mathematics of the lesson before watching the students' tackle the content in the video. We have observed that this activity gives the preservice teachers a better sense of what the students in the video are experiencing and also provides another perspective on the teacher's role in guiding the mathematical discussions.

5. How can we support methods instructors who are planning to use the CD in their classrooms?

As mathematics educators ourselves, one of our main pedagogical concerns was to build a system that would accommodate a variety of methods instructors who fall along the continuum between those who prefer directed questioning to those who prefer to devise their own questions. We therefore began with the premise that a separate facilitator's guide containing suggested questions and activities would be helpful. We modeled our guide after the work of Carne Barnett and her colleagues (Barnett, Goldstein & Jackson,1994) who have developed a number of techniques for bringing out issues embedded in text-based pedagogical cases. In addition, our research has shown that some instructors find the bookmarks particularly useful for further accommodating individual instructors' needs. For example, one instructor asked preservice teachers in his class to prepare bookmarks showing the ways in which the teacher conducted student questioning. One of our future development goals is to create a website that will enable instructors to upload and download others' bookmark files, thereby sharing their observations with a global community.

6. What technological boundaries will need to be overcome?

As with any cutting-edge technology project, there are boundaries that have to be pushed. We encountered and solved a number of technological obstacles through the diligent research and determination of our programmer. Some of the most critical resolutions included: 1) Fitting four hours of video on one CD-ROM, 2) Setting up a method for linking the transcript to the video, and 3) Creating an interactive version of the case with streaming video on the Internet.

Results and research to date

Our current work involves researching how the cases are used in methods classes. In brief, we have found the following: 1) Preservice teachers rate the searchable transcript as the most useful multimedia tool; 2) Instructors

feel that the extensions to the case, such as the mathematical activities and the in-depth video of target groups of students over time, support their efforts to communicate the complexities of the classroom in ways that video alone cannot; and 3) Teaching methods courses with multimedia requires a paradigm shift for most instructors who are used to the ease of showing a film during class and stopping it at appropriate times. To facilitate their efforts, we added a "View at 2x" feature that doubles the size of the video window and hence enables the video to be projected using an LCD projector connected to a computer.

These preliminary findings are informing our plans for more formal research. For example, we have found that researching the ways in which instructors change their uses of the case is more fruitful and interesting than just observing their initial use only. We have also realized that asking questions such as "What is the effect of the CD on preservice teachers' views of pedagogy, pedagogical content, and mathematics learning in general?" is not easy (or even possible) to measure. In fact, one colleague who used the case twice wrote

> The problem of noting change [in preservice teachers' views] is one that becomes particularly difficult whenever working with teachers in general, and preservice teachers in particular. Our preservice teachers are undergoing between 3 and 6 hours of instruction a day for the first 8 weeks [of the semester] they are spending time in their classroom observing their cooperating teacher and helping out, they are working with children in a variety of settings, they are reading, writing, viewing videotapes, and more. To consider the effects of even one entire course on their instruction is difficult, so imagine the complexities with trying to determine the effects of one three-hour session.

Therefore, we have redirected our research efforts to focus less on what the preservice teachers learned from their experiences with CD and more on what issues were raised during whole class or small group discussions that might have arisen if they were using video alone. In general, we can ask, "What did the CD make possible?" We have also decided to conduct some one-on-one interviews to answer questions such as what did they get from the use of the case and what opportunities were provided that would not otherwise have been attainable? We believe that answers to these questions will move the field of mathematics education forward by providing further concrete technological solutions to pedagogical questions.

References

Barnett, C., Goldenstein, D., & Jackson, B. (1994). Fractions, decimals, ratios, and Percents: Hard to teach and hard to learn? Portsmouth, NH: Heinemann.

Barron, L., Bowers, J., & McClain, K. (1996, October). Evaluating an interactive CD-ROM designed for preservice teacher education. In L. Puig, A. Gutierrez (Eds.), Proceedings of the Twentieth Conference of the International Group for the Psychology of Mathematics Education, (Vol. 1, p. 208).

Bowers, J., Barron, L., & Goldman, E. (1994, March). An interactive media environment to enhance mathematics teacher education. In J. Willis, B. Robin, & D. A. Willis (Eds.), Technology and teacher education annual (pp. 515-519). Washington, DC: Society for Technology and Teacher Education.

Doerr, H., McClain, K., & Bowers, J. (1997, July). Design principles for developing integrated multimedia instructional materials. In E. Pehkonen (Ed.) Proceedings of the Twenty-First Conference of the International Group for the Psychology of Mathematics Education (Vol. 2, pp. 217-224). Lahti, Finland: University of Helsinki.

Merseth, K. K. & Lacey, C. A. (1993). Weaving stronger fabric: The pedagogical promise of hypermedia and case methods in teacher education. Teacher and Teacher Education, 9(3), 283-299.

Mousley, J. & Sullivan, P. (1997, July). Dilemmas in the professional education of mathematics teachers. In E. Pehkonen (Ed.) Proceedings of the Twenty-First Conference of the International Group for the Psychology of Mathematics Education (Vol. 1, pp. 31-45). Lahti, Finland: University of Helsinki.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. Educational Researcher, 15(2), 4–14.

Schon, D. A. (1983). The reflective practitioner: How professionals think in action. New York: Basic Books, Inc.

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

NOTICE

REPRODUCTION BASIS

☒ This document is covered by a signed "Reproduction Release (Blanket) form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

☐ This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").